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VALVULAR HEART DISEASE

NON-INVASIVE EVALUATION OF EFFECTIVE ARTERIAL ELASTANCE: APPLICATION TO MITRAL REGURGITATION

ACC Poster Contributions

Ernest N. Morial Convention Center, Hall F

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Background: Left ventriculo-atrial pressure gradient, which affects regurgitant fraction (RF) in patients with mitral regurgitation (MR), depends on afterload. However, it is difficult to evaluate afterload quantitatively. Diastolic pressure, pulse pressure, and augmentation index are used as indices of afterload, but these indices do not include the net stroke volume ejected to the aorta, which is essential for the working condition of the heart. In the analysis of ventriculo-arterial interaction, ventricular afterload is represented by an effective arterial elastance (Ea) which is the slope of the arterial end-systolic pressure-stroke volume relationship. We devised an ultrasonic method of obtaining Ea and evaluated the effect of Ea on MR.

Methods: We non-invasively obtained arterial pressure waveforms using carotid arterial diameter-change waveforms measured with an echo-tracking system in 70 consecutive sinus rhythm patients with MR (42 men, age 52 ± 13 years) who were scheduled for surgical treatments. Arterial end-systolic pressure (ESP) was defined as the pressure at the point of dicrotic notch. Ea and RF was given as $Ea = ESP / (\text{aortic stroke volume})$ and $RF = (\text{regurgitant volume}) / (\text{mitral stroke volume})$, which were obtained by Doppler echocardiography. Diastolic pressure, pulse pressure, and augmentation index were also measured.

Results: Ea was 1.70 ± 0.54 mmHg/ml. RF ($56 \pm 9\%$) was not correlated with diastolic pressure, pulse pressure and augmentation index, but correlated with Ea ($y = 8.2x(Ea) + 41.7$, $r = 0.52$, $P < 0.0001$). There was no significant correlation between Ea and the left ventricular end-diastolic volume, but the ratio of RF to the left ventricular end-diastolic volume was correlated with Ea ($y = 0.15x(Ea) + 0.15$, $r = 0.59$, $P < 0.0001$).

Conclusions: Increased Ea suggests larger regurgitant fraction for the same left ventricular volume. The effect of afterload on MR can be evaluated quantitatively by using the non-invasive method of evaluating Ea, which has a potential to elucidate the effect of ventriculo-arterial interaction on various cardiac diseases.